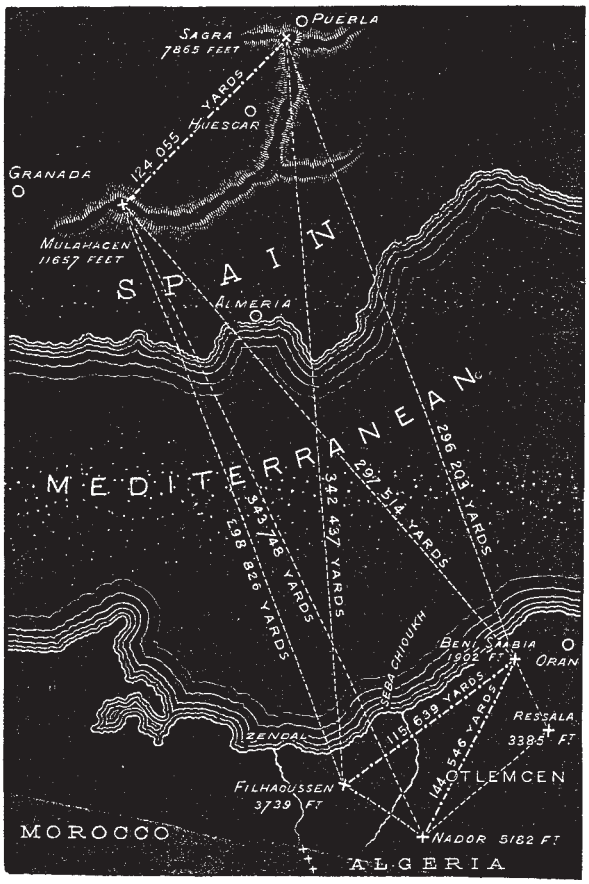
CAPTAIN PERRIER'S GEODETIC OPERATIONS IN ALGERIA

THE idea of prolonging the French arc of meridian to Sahara by the direct trigonometrical junction of Spain and Algeria, an idea of undoubted scientific value, presented itself to the mind of Captain Perrier when he was collecting the preliminary materials for the survey of Algeria. That survey was begun at the same time as the conquest, in the middle of military operations.

The design was to calculate two great lines conforming to parallels, and transversely cut by three meridians; quadilaterals would be thus formed, completed by triangles of the first order. Only a linear chain was however drawn, except in the mountainous regions where the operations would have been attended with too many difficulties.



Map showing prolongation of Meridians from Spain to Algeria

This chain, connected with the sea by three excellent bases, would serve the purpose of adjusting and arranging the detailed operations. French geodesy thus measured an arc of latitude cutting the Paris meridian and extending from Morocco to Tunis, with a length of 990 kilometres.

The chain of first-order triangles may be divided into two parts, the first from Blidah to Tunis, measured by Captain Versigny, the other more recent measured by Captain Perrier.

The admirable choice of triangles, stations, and signals is noteworthy. Those signals have been built by the observers themselves, as there were no steeples. The precision obtained is remarkable. In the sum of the three angles of any triangle, the error is about 3″·12 (centesimal seconds) * in M. Versigny's operations (who made use of Gambey's repeating circles); the error is about 3″·07 in M. Perrier's operations, who made use of Brunner's excellent asimuthal circles. In order to measure the bases, the system of M. Porro, an Italian engineer, has been employed, in preference to the old method of Borda, and it has been followed by the best results.

Colonel Levret proved (in 1869), by very exact calculations, that the passage by Gibraltar could be dispensed with, and that it would be possible to communicate between Spain and Algeria, in spite of the immense distance between the two continents. The entire certainty of that possibility has been proved by Captain Perrier, who has pointed out in a precise manner the names and positions of the visible summits and the length of the sides of the new chain.

It was only on October 18, 1868, that he managed to perceive the Spanish shore: he saw it from Seba Chioukh, near the mouth of the Tafna, very distinctly and without the glass. A serrated ridge was to be seen in the distance, toward the north-west, with five prominent summits. The distinctness was so perfect, that he could discern with his naked eyes the different parts of those mountains, those which were in the shade and those illuminated by the sun. He thus measured azimuths with the summit of the Tessala, the zenithal distances of the two highest points of the ridge, and the zenithal distance of the horizon of the sea.

After his return to France, he compared his measurements with the survey of Spain, made by Colonel Cuello, and concluded that he had observed the Mulahacen of the Sierra Nevada, and the peak of Sagra of the Sierra Sagra, the highest points of the Sierras of the Province of Granada.

In Spain the peaks of Sagra can be seen from Mulahacen; those mountains belong to the primordial geodetic chains of the Iberic peninsula. In Africa the points of the quadrilateral (Bem Saabia, Tessala, Filhaoussen, and Nador) are reciprocally visible, and the three last are situated in the primordial chain of Algeria.

With these points, Captain Perrier was enabled to form a chain common to Europe and Africa. Leaving the station of Seba Chioukh as superfluous, as well as the direction of Nador-Sagra as being too close to the horizon of the sea, he delineated that immense pentagon formed by the five summits of Mulahacen, Sagra, Bem Saabia, Filhaoussen, and Nador, every side and diagonal of which, except one, are the directions that are to be observed. He has even calculated and valued in round numbers the length of the sides of this geodetic chain. He has found—

	Metres.
Mulahacen-Filhaoussen .	273,400
,, Nador . . .	314,500
,, Bem Saabia .	272,200
Sagra-Filhaoussen . . .	313,300
,, Bem Saabia . .	271,000

The length of the terrestrial sides are—

	Metres.
Bem Saabia-Filhaoussen .	109,800
,, Nador . . .	104,800
Mulahacen-Sagra . . .	113,900

With those approximate numbers (and valuing at 0·08 the coefficient of refraction) he has calculated the altitudes of the two Spanish mountains. The measures thus obtained differ little from the real numbers—

	Metres.
Mulahacen	3,994
Sagra	2,398

given by Colonel Cuello, and thus furnish a new verification.

As the geodetic operations are being continued with great activity in Spain and in Algeria, we may hope that in a few years the geodetic bases of Great Britain, of France, Spain, and Algeria, reduced to the same unit of

* One centesimal second = 0″·33 ordinary second.

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measure, can be connected by continual chains of triangles; and the meridian line of France already prolonged northward to the Shetland Islands, carried out in Spain by the officers of that country, will reach the African Continent and extend to the Sahara, with a length of 30°.

France will then be able to oppose to the Russian arc and to the one measured in Central Europe the French arc, which, passing over plains and very high mountains, will cross the North Sea and the Mediterranean.

There is thus considerable truth in the words of M. Faye :—"Let us not forget that the French, who are at the present time so often reproached with their geographical ignorance, are the real creators of continental or maritime geodesy, and that they have continually, since Cassini to our days, published admirable geodetic papers, which have served as models to our rivals; the truly learned men abroad have always acknowledged their value."

The map of Algeria will be constructed on the same plan as the map of France, to the scale of $\frac{1}{400000}$, but as it will be coloured, and as level curves will be substituted for hatchings, it will have considerable advantages over the latter. M. CORNU

NOTES

THE French *Société d'encouragement* have awarded to Sir Charles Wheatstone, F.R.S., the Ampère medal for his remarkable works in theoretic and applied physics. The grand prize of 12,000 francs for the discovery most useful to French industry has been awarded to M. Pasteur, for the improvements he has introduced into the manufacture of silk, of wines, of vinegar, and of beer. A prize of 3,000 francs has been awarded to M. Gramme for the construction of an apparatus giving an electric current constant in direction and in intensity, whose electromotive force and conductibility are equal to those of an azotic acid pile of 60 or 80 elements of ordinary size, and superior both in economy and solubility to the apparatus which are at present in use.

AT the present time there are staying in England two illustrious physiologists, Prof. Kolliker and Prof. Fick, the former the renowned head of the Histological School, and the latter of the Physiological Institute in the University of Wurzburg.

THE University of Cambridge has accepted a fund raised by several members of St. John's College for the purpose of founding a prize to be called the Adams Prize, for the best essay on some subject of pure mathematics, astronomy, or other branch of natural philosophy. The prize is to be given once in two years, and to be open to the competition of all persons who have at any time been admitted to a degree in the University. The examiners have given notice that the subject for the prize to be adjudged in 1875 is a Theory of the Reflection and Refraction of Light.

BY the present monthly mail a testimonial, consisting of a silver tea and coffee service, is being sent to Dr. Kirk at Zanzibar, by the Royal Geographical Society. The inscription states that it is given in recognition of the services Dr. Kirk has rendered to his country and to science by his generosity, intelligence, and zeal in the advancement of African discovery.

MR. A. H. GARROD, B.A., has been appointed Lecturer on Zoology and Comparative Anatomy at the Charing Cross Hospital. Mr. Garrod, we believe, intends to give a course of lectures during the summer.

AT the general monthly meeting of the Royal Institution of Great Britain, on Monday, April 7, the special thanks of the members were returned to Dr. Warren De La Rue, for his donation of 100*l.* towards the expense of fitting up the new Laboratories.

THE Report to the Board of Visitors of the Astronomer Royal for Scotland, gives a satisfactory account of the work, astronomical and meteorological, done at the Royal Observatory, Edinburgh. The alterations in the observatory have been completed, and the new equatorial, referred to in NATURE some months ago, is nearly ready for use, though we are sorry to see that its efficient working is very likely to be marred from want of funds. Though much needed for various purposes, Government (with a surplus of nearly five millions!) have absolutely refused to grant any additional aid to the Edinburgh Observatory. Prof. Piazzi Smyth compares his position to that of an "unfortunate artillery officer who should have received a big gun, of perhaps the most approved wrought iron and steel construction in itself, but without means of moving it, without powder and shot; and yet should be expected by the public to be continually firing it with immense success and at all sorts of objects throughout the whole year."

WITH reference to the sum of 500*l.* placed at the disposal of the Council of the Society of Arts, through Sir William Bodkin, by a gentleman who does not wish his name to appear, for promoting, by means of prizes or otherwise, economy in the use of coal for domestic purposes, the Council have decided to offer the following prizes:—1. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, answer best for warming and ventilating a room.—The Society's Gold Medal and Fifty Pounds. 2. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, best answer for cooking food, combined with warming and ventilating the room.—The Society's Gold Medal and Fifty Pounds. 3. For the best new and improved system of apparatus which shall, by means of gas, most efficiently and economically warm and ventilate a room.—The Society's Gold Medal and Fifty Pounds. 4. For the best new and improved system of apparatus which shall, by means of gas, be best adapted for cooking, combined with warming and ventilating the room.—The Society's Gold Medal and Fifty Pounds. 5. For any new and improved system or arrangement not included in the foregoing, which shall efficiently and economically meet domestic requirements.—The Society's Gold Medal and Fifty Pounds.

WE understand that the scientific authorities at Berlin are preparing a manual containing the necessary information for the requirements of the various expeditions sent out by the Imperial Government to observe the transit of Venus. The information given will by no means be confined to astronomical and physical subjects, but will incorporate all the branches of natural history. We hope our Government will follow so excellent a precedent, and associate a certain number of naturalists along with the astronomical observers, especially in situations where their observations are likely to prove of value.

THE forty tanks in the Brighton Aquarium, under Mr. Savile Kent's superintendence, are now well stocked with fishes, and present a most interesting field of study to the Ichthyologist. Eight of them are devoted to fresh-water fishes, and the remaining to the marine forms. Amongst the latter are fine specimens of the herring, lump-sucker, grey, streaked and red gurnets, sting-ray, balan wrasse, cook and cork-wing wrasses, and gold-sinny. Two species of dogfish have deposited eggs in their tanks, and the embryos are in process of development. The most recent addition to the fresh-water fishes is a fine salmon, presented by Mr. Berridge, Chairman of the Usk Fisheries. The two porpoises are in excellent health, and feed well on smelts and small whitings. The large tank, 100 feet in length, and containing 110,000 gallons of sea-water, gives them ample space for their gyrations.

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